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Dissolved iodine distributions and speciation across the Eastern Tropical Pacific Oxygen Minimum Zones

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Understanding marine iodine biogeochemistry is essential for characterizing environmental processes relevant to atmospheric chemistry, palaeoclimatology, and redox and biological oceanic transformations. The iodide–iodate redox couple is a key indicator of sub-oxic conditions within oxygen minimum zones (OMZs). However, significant uncertainty remains regarding the extent of iodine excesses or deficits, the inorganic speciation of iodine, and the role of organic iodine in these regions. This study investigates the distribution and speciation of dissolved iodine in the OMZs of the Eastern Tropical Pacific Ocean, aiming to clarify these unresolved aspects. First, total dissolved iodine concentrations were determined in seawater profiles using isotope dilution mass spectrometry, which revealed iodine deficits at the surface across this region and at intermediate depths in the North Pacific OMZ. Next, we utilized mass spectrometry to measure the distributions of iodide and iodate with increased precision in these environments, comparing our results with existing data. Elevated iodide concentrations were identified in areas of the North Pacific OMZ that showed a deficit in total dissolved iodine, a pattern not observed in the South Pacific OMZ at the time of sampling. To assess the contribution of dissolved organic iodine recovered by solid phase extraction of filtered seawater to total dissolved iodine, we analyzed its concentration and complexity in samples from the Equator and the South Pacific OMZ. Although distinct organic iodine compounds were detected within the upper 1,000 m of the water column, their contribution to the total dissolved iodine pool was minimal. This study advances our understanding of iodine speciation and distribution in oxygen poor environments, leveraging high precision methodologies to uncover unexpected distribution patterns.